Litton ADVANCED CIRCUITRY

P. O. Box 2847, Commercial Station, Springfield, Mo. 65803 417 862-0751

February 19, 1982

Mr. David Doyle
United States Environmental
Protection Agency
Region VII
324 East Eleventh Street
Kansas City, Missouri 64106

RE: Certified Letter
Reference Groundwater Monitoring

Mr. Doyle:

Having received your certified letter of February 17, 1982, and discussed the situation with Mr. John Morse, the following is our response to your questions.

This facility has not implemented a system at this time because we have been working with the Missouri Department of Natural Resources concerning those requirements and have not as yet received approval on our groundwater well construction and monitoring program as submitted. We have had a qualified Hydrologist draw up both of the above mentioned plans and are currently waiting for review, comment, and approval from this state. When approval has been received, construction bids will be sent out and the monitoring wells will be constructed in the shortest possible time.

Attached are the Groundwater Monitoring Program, Specifications for Construction, and a letter from David Bedan, Missouri Department of Natural Resources concerning compliance and completion dates requested by the State of Missouri.

According to the above schedule, this facility will install and implement the Groundwater Monitoring Program before April 9, 1982, assuming that the State of Missouri has no questions or changes in the plans submitted to them.

As you know, the first year of data accumulated for a surface impoundment is used to set up background data. It should be noted that the existing lagoon for which the Groundwater Monitoring Program is proposed is to be put out of service and removed from the site within the next year. By the time this background data has been established, the lagoon will no longer exist, therefore the Groundwater Monitoring System will have served no purpose in any case.

I have indicated in my correspondence with the Missouri Department of Natural Resources that if they felt any of this information was deemed necessary to be submitted to the Environmental Protection Agency, they should feel free to forward same.

If you have any questions, please contact me.

James K. Dow
Director of Technical Resources

JKD/cm

Attachments

cc: Burt McCullough
Missouri Department of Natural Resources

GROUNDWATER MONITORING PROGRAM

for

LITTON ADVANCED CIRCUITRY DIVISION

Springfield, Missouri

Submitted To:

Litton Advanced Circuitry Division

by

Jerome A. Westphal, Ph.D. P.E.
Consulting Hydrologist

December 22, 1981

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GROUNDWATER MONITORING PROGRAM

for

LITTON ADVANCED CIRCUITRY DIVISION
Springfield, Missouri

LOCATION

The ground-water monitoring program will be implemented at the facilities of Litton Advanced Circuitry Division, 4811 West Kearney, Springfield, Missouri. The impoundment for which the monitoring program is designed is located in the SE 1/4, SW 1/4, T29N, R22W (37° 14' 38" N, 93° 22' 33" W).

PURPOSE

Purpose of the monitoring program is to ensure prompt detection of any contamination of shallow groundwater in the Burlington-Keokuk Formation which may result as a consequence of seepage from a surface impoundment containing treated effluent from processes associated with the manufacture of electric circuit boards.

HYDROGEOLOGIC SETTING

According to Emmett, Skelton, Luckey, Miller, Thompson and Whitfield ("Water Resources and Geology of the Springfield Area, Mo.," Water Resources Report No. 34, Missouri Dept. of Natural Resources and U.S. Geological Survey, 1978), the major aquifer in the area of

Springfield includes the entire stratigraphic sequence from the Potosi Dolomite in the Upper Cambrian System to the Cotter Dolomite which is the uppermost member of the Ordovician System. This aquifer is more than 1000 feet thick and consists primarily of dolomite with minor sandstone units. Ground-water flow in this aquifer is confined by two relatively impermeable formations.

The Northview Formation is the upper confining layer for the major aquifer. It is comprised primarily of siltstones and shales. In the vicinity of Litton Advanced Circuitry Division, the Northview Formation is probably about 30 feet thick (Emmett, et. al., 1978, Figure 4). The Northview Formation retards flow from the overlying minor (shallow) aquifer to the major aquifer.

The minor (shallow) aquifer overlies the Northview Formation and is comprised of cherty limestones of Mississippian age. Well yields in this aquifer are generally 20 gallons per minute (gpm) or less. The uppermost member of the minor aquifer within a 10-mile radius of Litton Advanced Circuitry Division is the Burlington-Keokuk Limestone. This member consists of fine to coarsely crystalline limestone and ranges in thickness from about 155 feet to 270 feet. This formation is at or near the surface throughout most of western Greene County. It is deeply weathered and contains numerous sinkholes. In the vicinity of Litton Advanced Circuitry Division, the Burlington-Keokuk formation is overlain by approximately 15 feet of unconsolidated alluvium.

For the major aquifer, Emmett, et. al. (1978, Plate 3) show a well defined cone of depression which is centered on the City of Springfield. In this location, thickness of the Northview Formation

is probably about 20 feet (Emmett, et. al., 1978, Figure 4). The Litton Advanced Circuitry Division is apparently located somewhat outside the periphery of this cone on a broad, flat piezometric divide to the northwest. With existing data it is not possible to say with certainty which direction groundwater in the major aquifer flows beneath Litton Advanced Circuitry Division. However, from the interpretation of Emmett, et. al. (1978, Plate 3), it appears that flow would be to the northwest in the absence of the cone of depression.

According to Mr. Don Miller, Geologist with the Missouri Division of Geology and Land Survey, there were an insufficient number of water-level data from shallow wells to establish a piezometric map for the minor (shallow) aquifer in Springfield (personal communication). Consequently, it is not possible to establish the prevailing direction of ground-water movement in the shallow aquifer below Litton Advanced Circuitry Division. Because the Northview aquitard is 30 feet thick in this location and tends to get thicker to the north and northwest, and because Litton Advanced Circuitry Division is outside the periphery of the drawdown cone in the major aquifer, it is unlikely that drawdown in the major aquifer has a measureable effect on the configuration of the piezometric surface in the minor (shallow) aquifer at this location. It is likely that the prevailing hydraulic gradient in the minor aquifer will be generally northward and westward, the same as would occur in the major aquifer in the absence of ground-water pumpage from the City of Springfield.

Litton Advanced Circuitry Division is located approximately one mile north of the topographic divide which separates the Sac River Basin from the James River Basin. The impoundment of interest lies on

terrain which slopes gently to the north. U.S. Geological Survey 7.5 minute topographic quadrangle maps (Brookline, Ebenezer, Springfield and Willard) show ample evidence of collapsed sinkholes in every direction surrounding the impoundment. Surface drainage from the impoundment site is generally to the north and its precise direction is locally controlled by topography in the vicinity of collapsed sinkholes. The closest sinkhole to the impoundment is about 300 feet southeast, but on the opposite side of a low topographic divide. Two more are located east-northeast at distances of about 800 feet and 1300 feet respectively. A fourth is located about 1200 feet directly north of the northeast corner of the impoundment.

From inspection of the Springfield and Ebenezer 7.5 minute quadrangle sheets, there appears to be a concentration of collapsed sinkholes on a northeast trending line about 0.8 miles east of the Litton Advanced Circuitry Division. As may be observed on the Willard 7.5 minute quadrangle, there also seem to be an inordinate number of sinkholes extending from a position about 0.5 miles north of the impoundment to about 1.5 miles to the north and west of north. It is possible that these surface expressions of sinkholes and/or collapsed sinkholes indicate generally preferential flow paths for groundwater in the minor aquifer as it moves toward the Little Sac River.

MONITORING SYSTEM

Based on hydrogeologic and topographic evidence, it appears likely that groundwater in the minor (shallow) aquifer flows generally northward beneath Litton Advanced Circuitry Division. However, because the

extent of deep weathering of the Burlington-Keokuk Formation appears to be particularly severe a short distance to the east as well as to the north and northwest, it is difficult to predict exactly which flow path seepage from the impoundment might take as it leaves Litton Advance Circuitry Division property. For this reason, downgradient monitoring wells are located with respect to most probable directions of groundwater flow away from the impoundment.

As shown on Figure 1, well D1 is located to the east of the impoundment along the east property line of Litton Advanced Circuitry Division. This location was chosen with regard to the possibility of flow toward the sinkholes to the east. Well D2 is located north on a line between the impoundment and the closest sinkhole to the north. Well D3 is located so as to intercept flow from the impoundment to the northwest. To minimize risk of inadvertant aquifer contamination during well construction or contamination as a consequence of faulty well construction, downgradient wells were drilled at distances ranging from about 80 feet to 150 feet from the impoundment.

As shown on Figure 1, well U1 is an upgradient monitoring well. It is located about 750 feet south of the lagoon near the property boundary. This should be a sufficient distance to preclude the inducement of seepage from the impoundment toward the well during sampling.

Figure 2 shows general specifications for all four monitoring wells. Wells are to be a minimum of 6 inches in diameter and at least 150 feet deep. The upper 80 feet will be cased with blank PVC casing. The annular space outside the casing will be sealed with grout or other

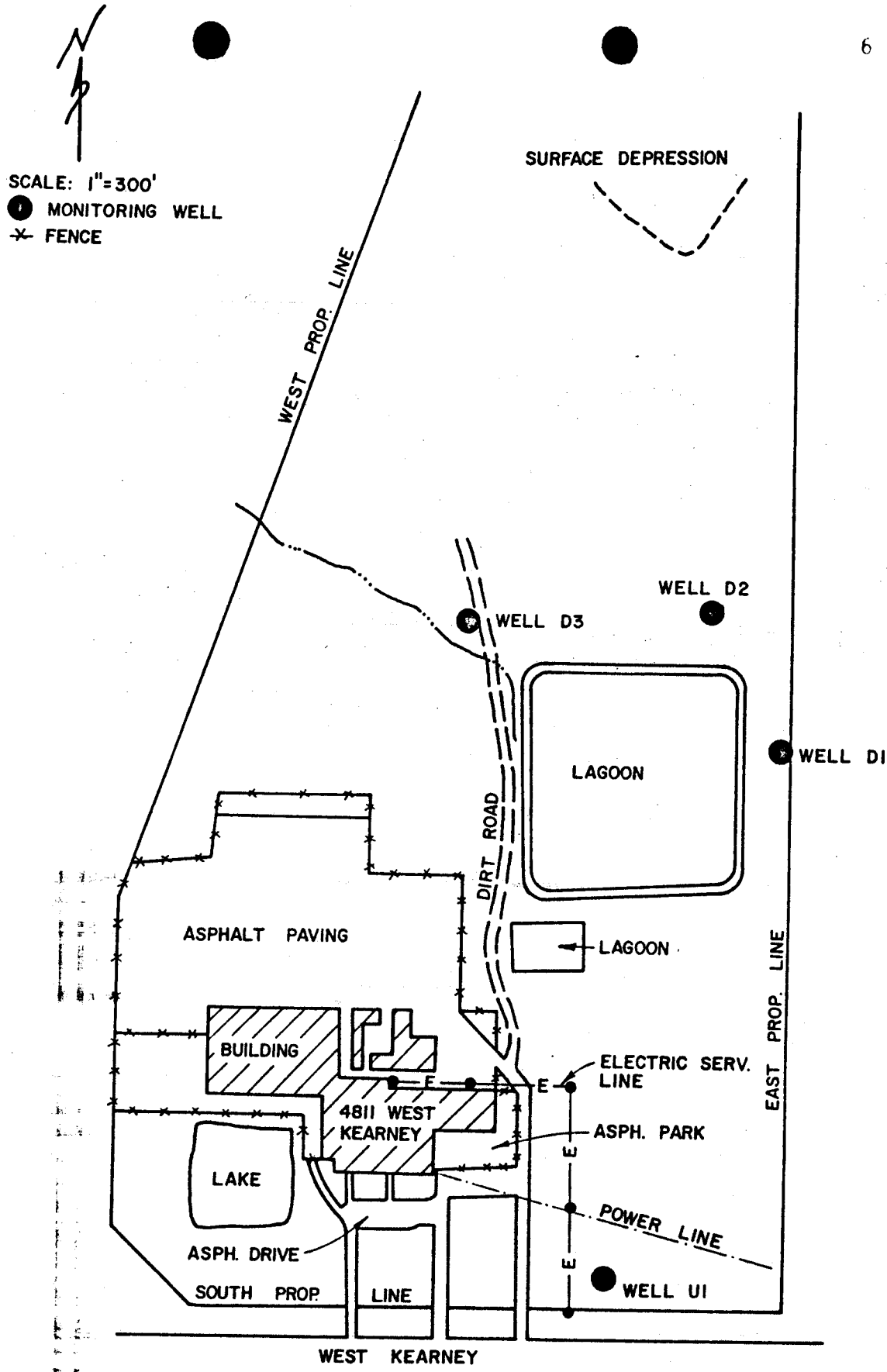
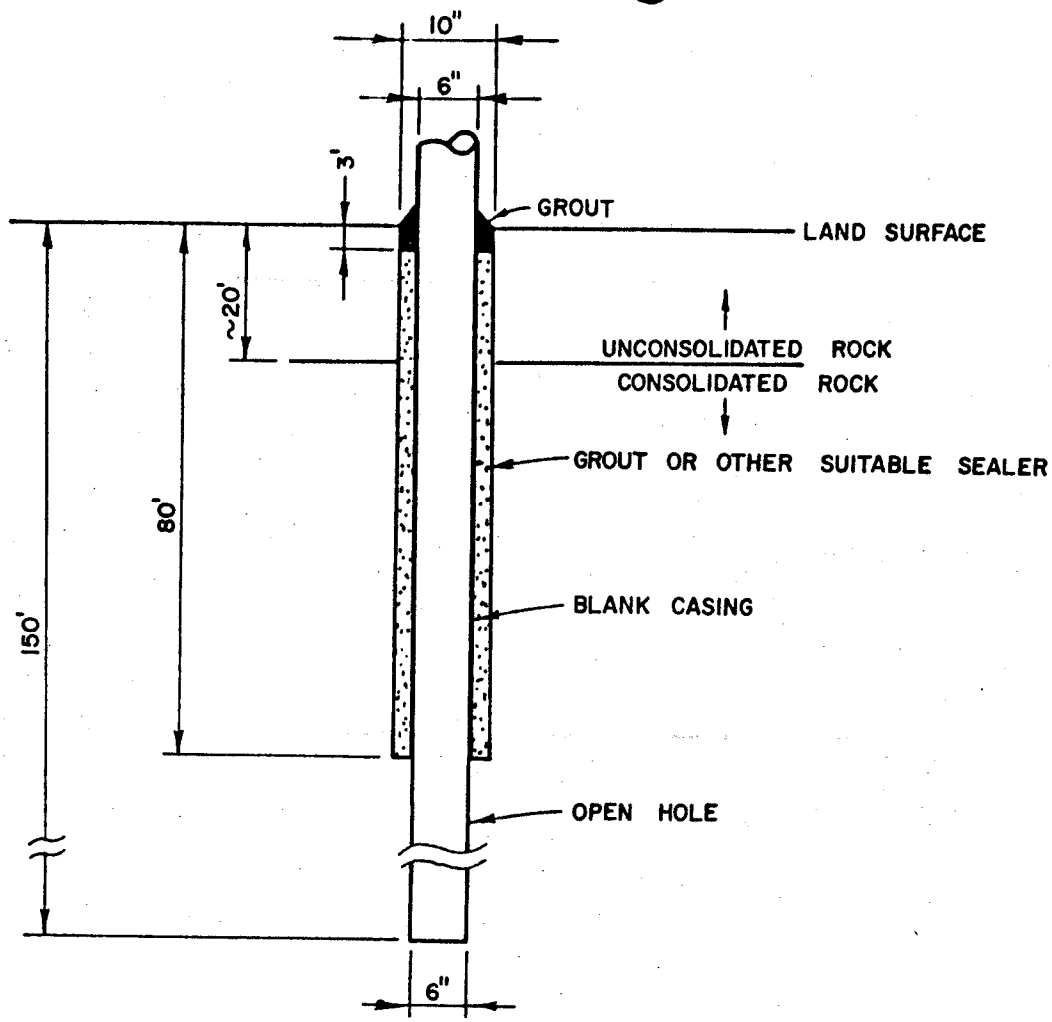
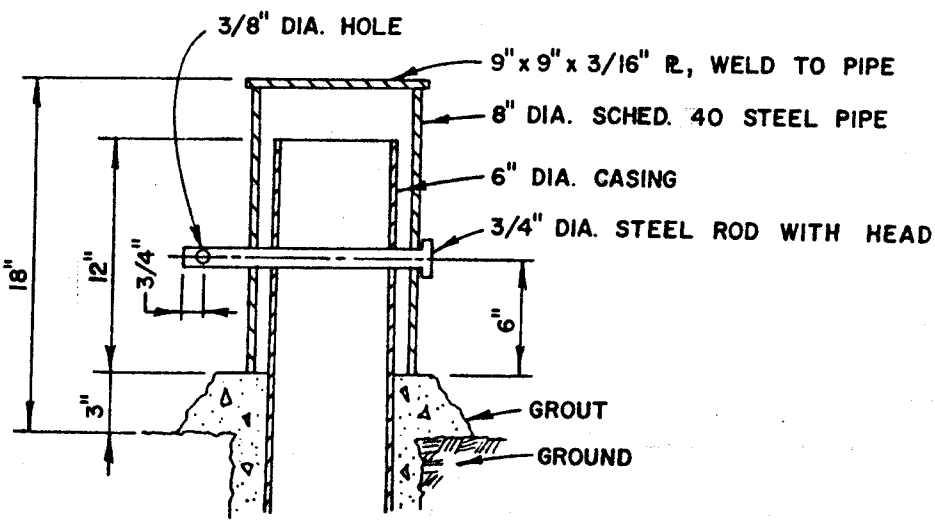


FIGURE 1: WELL LOCATION MAP



WELL



WELL COVER

FIGURE 2: WELL SPECIFICATIONS

suitable sealer to prevent vertical seepage along the casing. A lockable steel well cover will be installed to prevent inadvertant down-hole contamination and vandalism.

For purposes of water-level monitoring, a point on the top edge of the casing of each well will be marked with a notch or indelible marking. Elevation of these points will all be determined by surveying relative to a common, convenient datum.

SAMPLING AND ANALYSIS

Sample Collection: Prior to pumping any monitoring well, depth to water below the measuring point on the top edge of the casing will be measured and recorded noting well number, date, time and depth to water. Water levels will be measured using an electric sounder, steel tape with a chalk covered section to show wetting line, or a method of equivalent accuracy. Measurements will be read to the nearest 0.01 foot (or 1/8 inch if using inch calibrated tape).

After measuring depth to water, the well will be pumped for a sufficient time to evacuate a volume of water equal to that volume standing in the well prior to pumping. The pump will have plastic impellers and non-metallic fittings on the discharge line. Only after the standing water has been removed will samples be collected for analysis.

Samples will be collected in either polyethylene or glass containers. Samples to be analyzed for metals will have polypropelene caps without liners. Each container and cap will be thoroughly rinsed with water from the well immediately prior to filling the container. At each well,

temperature, pH and specific conductance will be measured on one of the unpreserved samples in the field prior to sealing. At each well, a minimum of one liter of water will be collected for determination of those inorganic non-metallic constituents which require no preservatives or fixatives. For determination of metallic ions, one-half liter will be collected, filtered on site and preserved with nitric acid. Separate samples will be collected for each of the other constituents requiring filtration and/or preservation. After sealing, each container will be marked with indelible ink to denote the well, date and time of collection. In addition, those samples having preservatives will be identified commensurate with the laboratory determinations for which they are intended.

Upon completion of sample collection at all four monitoring wells, samples will be delivered to Litton Advanced Circuitry Division laboratories where they will be stored according to recommendations contained in "Methods for Chemical Analysis of Water and Wastes" (EPA-600/4-75-020, March 1979), pending analysis.

Required Determinations: Water from monitoring wells will be analyzed for the presence of inorganic constituents as specified in the National Interim Primary Drinking Water Standards. These constituents and their limiting concentrations are shown in Table 1.

In addition to constituents listed in Table 1, analyses will be made to determine concentrations of iron, manganese and sodium. These parameters, together with chloride, phenols and sulfates will be used as a basis for comparison in the event of ground-water quality assessment is required.

TABLE 1

Constituents and Limiting Concentrations for Which Determinations Will be Made

Arsenic	50 µg/l	Selenium	10 µg/l
Barium	1000 µg/l	Silver	50 µg/l
Cadmium	30 µg/l	Zinc	100 µg/l
Chromium (Total)	500 µg/l	COD	10 mg/l
Copper	20 µg/l	Threshold Odor Number	3
Cyanide	10 µg/l	Linear Alkylate Sulfonates	1 mg/l
Fluoride	1200 µg/l	Chlorides	250 mg/l
Lead	50 µg/l	Sulfates	250 mg/l
Nickel	800 µg/l	Total Dissolved Solids	500 mg/l
Phenols	5 µg/l	Nitrate (as N)	10 mg/l

Determinations of pH, specific conductance, Total Organic Carbon and Total Organic Halogen will be used as a basis for identifying possible ground-water contamination. For each sample, at least four replicate measurements of each of these parameters will be made. The initial background condition will be established by calculating the arithmetic mean and variance for each parameter from the first year of replicated measurements. The mean and variance of each parameter as determined from measurements on samples from the upgradient well will constitute the baseline ground-water quality condition.

Evaluation of Water-level Changes: Water-level measurements in the monitoring wells will be evaluated after each sampling effort to verify that the upgradient well is beyond the influence of the impoundment and that downgradient wells are located appropriately to intercept groundwater which could be contaminated by seepage from the impoundment. If analysis of water levels indicates that monitoring wells are inappropriately placed, then the situation will be remedied in consultation with the appropriate DNR personnel.

Sampling Frequency: During the first year, determinations will be made for all constituents listed in Table 1 plus pH, specific conductance, Total Organic Carbon, Total Organic Halogen, iron, manganese and sodium in water samples collected quarterly from each monitoring well. After one year, determinations of chloride, iron, manganese, phenols, sodium and sulfate will be made for samples collected annually from each monitoring well. However, after the first year of monitoring, measurements of pH, specific conductance, Total Organic Carbon and Total

Evaluat[illegible] ound-w[illegible]

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[illegible]m the [illegible]licate measurements and the mean will [illegible]

[illegible]

[illegible]parameter [illegible] comparison of mean [illegible] corresponding [illegible]

[illegible] for the baseline condition will be made at the one-percent level [illegible] nificance [illegible]

[illegible]t's t to determin[illegible] increase for decrease in [illegible]

[illegible]ved.

[illegible]

[illegible]und [illegible]ll be identa[illegible]

[illegible]rt to the Missouri Department of Natural Resources (DNR). In the [illegible]vent the mean for a p[illegible]

[illegible]ffers [illegible]meter increa[illegible] or pH [illegible]

[illegible]line condition at the upgradient well (by the criterion of [illegible]), additional [illegible] collected from the well(s) where th[illegible] was noted. [illegible] [illegible]lyzed for the parameter(s) which sh[illegible] sig[illegible] [illegible] mea[illegible] [illegible] [illegible] defi[illegible]ns [illegible] [illegible] [illegible] [illegible] fican[illegible] [illegible] for pH) [illegible] the bas[illegible]ean, [illegible] oth[illegible]

action will be taken. However, if the results verify a significant increase (pH decrease) from the baseline condition, DNR will be notified by writing within seven days of the assessment of change. Within 15 days of such a notification, Litton Advanced Circuitry Division will submit a ground-water quality assessment plan in accordance with 10 CSR25-7.011 (10)(D)4., subparagraphs B and C.

RECORD KEEPING AND REPORTING

Litton Advanced Circuitry Division will maintain records of all water quality determinations and water-level measurements taken as a part of this monitoring program for the active life of the facility and for the post closure period. During the first year of monitoring, concentrations of Total Organic Carbon and Total Organic Halogen and values of pH and specific conductance will be submitted to DNR in writing within 15 days of the end of the quarterly reporting period. In addition, if concentrations or values of any parameter listed in Table 1 exceed the tabulated value, the parameter, its value or concentration and the monitoring well where it was found will be contained in the quarterly report.

An annual report will be submitted to DNR which contains results of the previous year of monitoring at each well. It will contain results of the semi-annual determinations of pH, specific conductance, Total Organic Carbon and Total Organic Halogen. If there are significant differences (parameter increase, pH decrease) between the mean of the four replicate measurements of any parameter in water from the upgradient well

and the previously determined baseline condition, this evaluation will also be contained in the annual report. Finally, if it is determined from evaluation of water-level data that the requirements for representative sampling in upgradient and downgradient directions are not being fulfilled, this fact along with the proposed corrective action will be set forth in the annual report to DNR.